THE ELECTRICAL TICKLE

Stimulation of Plant Growth by Electricity, Magnetism & Sound.

Part 1

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In the 1990s there will be an inevitable recurrence of widespread drought in America, as in the 'dust bowl' years earlier in this century. It is very probable that famine will then stalk Americans as well as it now does North Africans. Fortunately, there is an elegant alternative technology that can prevent or end the problem. It is 'Electro-Culture'—the electrical stimulation of plant growth.

This centuries-old technology has been used to accelerate plant growth up to 400%, increase yields up to 1000%, improve crop quality, protect plants from insects, frost and disease, reduce fertiliser requirements, and more! It can be practised on any scale, from a potted plant to a field. It enables the farmer to harvest more and sooner! For example:

In England prior to World War I, some 150 farmers developed a shared system of treating grain in a bath of electrified nutrients and drying them before planting about 2,000 acres with such. Subsequently they enjoyed the benefits described above and below (excerpted from *Scientific American*, 15 February 1919):

"In the first place, there is a notable increase in the yield of grain from electrified seed... The yield of the electrified seed exceeds that of the unelectrified by from 4 to 16 bushels... The average...is between 25 and 30 per cent of increase... The increase in weight has ranged from one pound to as much as four pounds per bushel... Besides the increase in the bulk of the yield and the increase in the weight per bushel, there is an increase in the straw...whereas the bulk of the unelectrified seeds had thrown up only two straws per seed, the electrified had thrown up five... The straw growing from the electrified seed is longer... The stoutness and the strength of the straw is increased... The crop is less likely to be laid by storms... Corn growing from seed thus treated is less susceptible to the attacks of fungus diseases and wireworm.

"The effect produced upon the seed is not permanent; it will retain its enhanced efficiency only for about a month after electrification, if kept in a dry place. It is therefore desirable that the seed be sown promptly after it has been electrified... The grain must be steeped in water that contains in solution some salt that will act as a conductor... The seed is steeped in it, and a weak current of electricity is passed by means of electrodes of large surface attached to two opposite end walls of the tank. The seed is then taken out and dried.

"Seed that is to be sown on one kind of soil will yield better results with a calcium salt, and seed that is to be sown on another kind of soil will yield better results with a sodium or some other salt. One kind of seed will need treatment for so many hours, and another kind for many hours more or fewer. Barley, for instance, needs twice as long treatment as wheat or oats. The strength of the solution and the strength of the current must be appropriate, and are not necessarily the same in each case. The drying is very important. The seed must be dried at the right temperature, neither too rapidly nor too slowly; and it must be dried to the right degree, neither too much nor too little..."

Unfortunately and for no good reason, the programme was abandoned and forgotten after the war. It has not been revived, though a few agricultural scientists continue to report the results of their experiments with various other methods of Electro-Culture. Currently, the former USSR is most active in this field.

The several approaches to Electro-Culture include: (1) Antennas; (2) Static Electricity Generators; (3) Batteries; (4) Alternating Current; (5) Magnetism; and (6) Radio Frequencies. The subject also easily includes the applications of Sound and Discreet Lighting.

The energies are applied to the seeds, the growing plant, and to the soil, water, and/or air as appropriate. However, it is also easy to electrocute the plants, so gentle patience is the order of the season.

ANTENNA SYSTEMS

In 1924, Georges Lakhovsky devised his Oscillator Circuit, a one-turn copper coil with overlapping ends separated by a gap which builds up capacitance and generates oscillating currents of

FIGURE 1:

THE LAKHOVSKY COIL

benefit to plants. The ring is supported by an insulator such as a plastic rod. This extremely simple arrangement stimulates plant growth to an extraordinary degree. (Ref.: G. Lakhovsky, *The Secret of Life*, W. Heinemann, London, 1939.) (Figure 1)

Other configurations also enhance plant growth: a conical coil of stiff wire wound with nine turns (counter-clockwise in the Northern hemisphere; clockwise south of the equator) and stuck in the ground one foot north of the plant, will collect atmospheric energies. Wire fences can be converted by connecting wire to a metal rod sunk at least one foot into the Earth near the plants. A TV antenna also can be used in this way. Rebar (the steel reinforcement rods used in ferrocement construction) are very useful. Sink rebar three feet into the ground at each end of the row(s) of plants—preferably in a north-south orientation that will take advantage of the geomagnetic polarity—and run a bare wire under the soil beneath the plants and/or in the air. (Figure 2)

ELECTROSTATIC SYSTEMS

Experimental study of the effects of electricity on plant growth began in 1746 when Dr Maimbray of Edinburgh treated myrtle plants with the output of an electrostatic generator, thereby enhancing their growth and blossoming. Two years later, the French abbot Jean Nolet found that plants respond with accelerated rates of germination and overall growth when cultivated under charged electrodes.

In 1898, the Finnish scientist Selim Laemstrom experimented with an aerial system powered by a Wimshurst generator and Leyden jars. He found that electrical discharge from wire points stimulated the growth of plants. These results were confirmed in 1907 by the Swiss priest J. J. Gasner. The Laemstrom system comprises a horizontal antenna suspended high enough to permit ploughing, weeding and irrigation. The voltage applied to the antenna varies between 2 kV and 70 kV, depending on the height of the antenna. The current is about 11 amps/cm. These conditions produce about 45% increased yields. Experiments should not be conducted during midday or on hot, sunny days, lest the plants be burnt. The soil should be wet at the time to improve current flow. Electro-cultured plants require about 10% more water than control plants, perhaps because the positively-charged water is perspired from the leaves more rapidly than under normal conditions. (Ref.: Lyman Briggs, et al., *Bulletin* , USDA, no. 1379, January 1926.) (Figure 3)

DIRECT CURRENT SET-UPS

In the 1840s, W. Ross of New York reportedly obtained a severalfold increase in the yield of a field of potatoes (compared to control plants) when he buried a copper plate (5 feet by 14 inches) in the Earth, and a zinc plate of the same dimensions buried 200 feet away. The two plates were connected by a wire above ground, thus forming a galvanic cell. (Ref.: W. Ross, US Commissioner of Patents Report, vol. 27, p. 370, 1844.)

Similar experiments were performed by Holdenfleiss in 1844; he used copper and zinc plates which were charged with a battery. Yields were increased up to 25%.

In the 1920s, V. H. Blackman reported his experiments with an aerial system similar to that of Laemstrom. He applied a charge of 60 volts DC at one milliamp through 3 steel wires each 32 feet long and suspended 6 feet apart and 7 feet high on poles. This arrangement yielded an average increase of up to 50% for various plant types. (Ref: V. H. Blackman, *Journal of Agricultural Science*, vol. 14, pp. 240-86, 1924.)

In 1964, the US Dept of Agriculture performed tests at the University of California, where a negative electrode was placed high in a tree, and the positive electrode was connected to a nail driven into the base of the trunk. Stimulation with 60 volts DC substantially increased leaf density on electrified branches after one month. Over a period of a year, leaf growth was 300% greater than on non-electrified branches. (Ref.: A. D. Moore, *Electrostatics and its Applications*, Wiley & Sons, 1972.)

Electricity also can cure trees. A method was developed in 1966 to treat avocado trees affected with canker and orange trees with scaly bark. An electrode was inserted into the living cambium and phloem layers of the tree and the current passed into the

FIGURE 2:

ANTENNA SYSTEMS

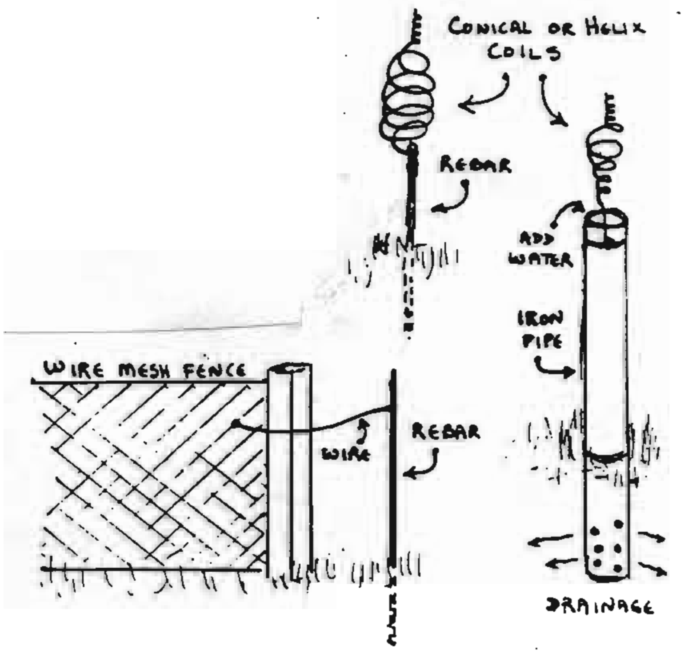
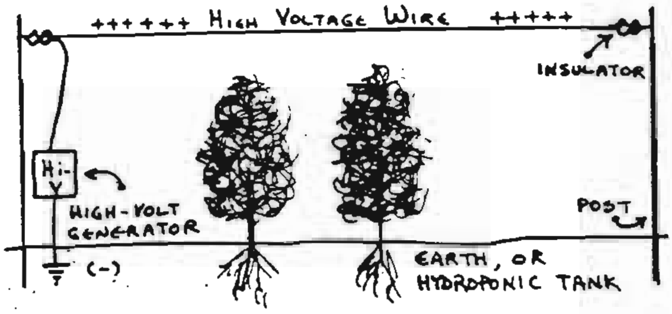


FIGURE 3: THE LAEMSTROM SYSTEM



branches, the roots or the soil. The treatment is best administered in the spring season. The length of treatment depends on the size and condition of the tree. After only one cycle of treatment, new shoots appeared on the branches. The bark was removed, and the trees began to bear fruit!

Soviet researchers have reported that, "During the passage of an electric current through the soil, the physicochemical properties of the latter are modified, the content of assimilable nitrogen, phosphorus and other substances is increased, evaporation is accelerated, and the redistribution of water is modified at the poles. Under the influence of the electric current the degree of aggregation of the soil is increased, its permeability to moisture is improved, and its alkalinity is reduced.

"The electric current stimulates the metabolism of seedlings, increases the intensity of their respiration and the activity of their hydrolytic enzymes, changes the soil pH, accelerates the breakdown of complex organic substances (lipids, starch) to simpler substances (monosaccharides) used for nutrition of the growing embryo.

"Short exposure of seeds to an electric current brings to an end the state of rest, speeds up development and increases the yield... Seeds with a low germination rate show a more marked effect...

"Plants exposed to the action of the current developed more rapidly throughout the period of vegetation. At the end of vegetation the experimental cotton plant possessed twice or three times as many pods as the control plant. The mean weight of the seeds and fibre was greater in the experimental plants also. In the case of sugar beet the yield and sugar content were increased, and in places near the negative pole the increase in sugar content was particularly high. The tomato yield was increased by 10-30%, and the chemical composition of the fruit was modified... The chlorophyll content of these plants was always greater than that of the control... Corn plants absorbed twice as much nitrogen as control plants during the vegetative period... The transpiration of the experimental plant was higher than that of the control, especially in the evening. Reports that the characteristics acquired by the plants in electrically treated soil are transmitted by inheritance to the third generation are particularly interesting.

"Under the influence of the electric current, the numerical proportions between hemp plants of different sexes was changed by comparison with the control to give an increased number of female plants by 20-25%, in connection with a reduction in the intensity of the oxidative processes in the plant tissues.

"In 1935 it was found that both alternating and direct electric currents had a bactericidal action, and this also affected the soil microflora. When an electric current was used to disinfect the soil of seed beds from cabbage mildew, the number of bacteria and fungi was considerably reduced (by 10 times or more in the case of of some species), while the population of actinomycetes was increased...

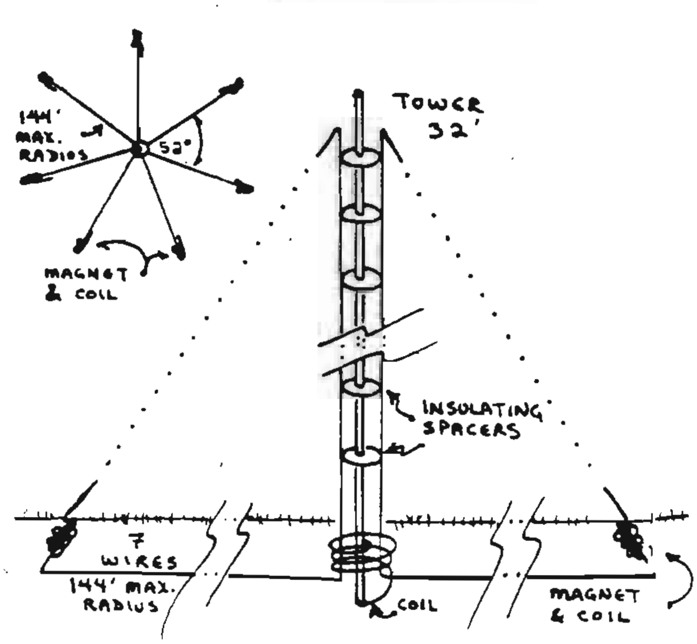
"The stimulating action of the alternating was greatest when the current passed through the soil had a density of 0.5 mA/sq. cm... A direct current with density of 0.01 mA/sq. cm. had approximately the same action. When these optimal current densities were used in hotbeds, the yield of green mass could be increased by 40%."

HIGH VOLTAGE A.C. SYSTEMS

In a system using alternating current, great care must be taken to prevent electrocution of oneself and the plants.

Alternating currents generally tend to retard plant growth except within certain narrow parameters of voltage and amperage. Dicotyledon plants increase in weight at low and high voltages (10 kV and 100 kV) but decrease in weight (as much as 45%) with voltages between 20 kV to 60 kV. Current flow should not exceed 0.7 x 10 amps per plant; higher currents retard plant growth.

FIGURE 5: DE LAND'S "FROST-GUARD"



L. E. Murr used aluminium wire mesh electrodes charged up to 60 kV and found that monocotyledons increase in dry weight in an electrostatic field, but decrease in weight in an oscillating field. The dry weight of dicots increases about 20% when grown in an alternating field, but decreases above 50 kV AC. There appears to be no benefit from continual exposure of plants to an alternating electrical field. If such a system is used, voltages should not exceed 10 kV, and the current must be very weak.

However, if one can manage such a system, the results can be worthwhile. For example, in a similar system, the maximum energy supplied was 50 watts (50 kV/1 mA) per acre for 6 hours daily for 6 months. The total energy supplied was less than 0.2% of the energy actually absorbed by the plants from sunlight alone. Only a fraction of this additional energy was available to plants, yet the increase in yields averaged about 20% (up to 50%)! Furthermore, it was found that electrical discharge applied only during the first month of the growing season may be as effective as continued treatment throughout the season!

Another application of high voltage AC to agriculture was described in *Popular Science* monthly for November 1927 and January 1928. A captioned photograph read: "How Electric Plow Wars Against Crop Pests: The wires of this plow, invented by L. Roe of Pittsburgh...flash 103,000 volts of current between the plow shares to kill all pests in the soil."

In 1939, Fred Opp of Costa Mesa, California, produced a garden soil cultivator that used high-tension electric current to increase the nitrogen content and thus improve its fertility. An illustrated article in *Popular Science* monthly (October 1939) described "A generator with an output of 110 volts AC, a storage battery for exciting the armature field, and a transformer that steps up the current to 15,000 volts...mounted on a walking-type garden tractor equipped with a small gasoline motor that drives both the tractor and the generator. Current is conducted through a pair of electrodes to furrows in the soil made by a cultivator. As the electrodes are dragged along, soil falls on top of them, making the contact."

The same method was incorporated into the Electrovator invented by Gilbert M. Baker of Mendota, California, in 1946. As reported in the September issue of *Popular Science*, "It is a trailer containing a gasoline-driven 12.5 kilovolt-ampere generator and a special transformer. Two rakes with copper electrodes for teeth transmit the high-voltage, low-amperage current to weeds as the machine is drawn at one mile an hour by a jeep or tractor. The weeds burn, from the tops to root-tips, leaving the land ready for new crops. The treatment can be repeated for successive growth..."

The treatment of seeds in an electric field before sowing gives a consistent increase in yield of 15% and up. According to experimenters L. A. Azin and F. Y. Izakov, "It must be noted that electric fields are of two types: an electrostatic field and a corona discharge field. The electric field of the corona discharge differs from the electrostatic field by possessing considerable heterogeneity and by the precession of space charges of the same sign in its working zone. Because of this, any particle, including a seed, receives a charge of the same sign in such a field. The electrostatic field is homogeneous and does not possess space charges, although charging may take place here because a seed, if placed on the metal electrode, acquires a charge by contact, corresponding in its sign to the polarity of the electrode."

Soviet researchers N. F. Kozhevnikova and S. A. Stanko reported on their "experiments over a number of years to study the effect of an alternating electric field on the sowing properties of the seeds, the growth and development of plants, and the yield. It has been found that after treatment in optimal conditions, the yield of green mass is increased by 10-30%, and the yield of grain by 10-20%. Besides the increased yield, treatment of seeds with an alternating current may improve other economically valuable properties of cultivated crops: the leaf cover of the plants may be increased, the vegetative period may be shortened, the absolute weight of the grain may be increased, and so on..."

The seeds were treated with 2-4 kV/cm intensity of the electric field, with 8 kV on the electrodes of the working chamber. Exposure was for 30 seconds or one hour. It was found that if treated seeds were kept for 10 to 17 days before sowing, the mature plants would contain up to 86% more chlorophyll and 50% more carotenoids than the controls! (Ref.: *Applied Electrical Phenomena*, no. 2, March-April 1966.)

Other Soviet scientists have reported similar results achieved under various conditions of corona discharge treatments of seeds:

"After electric treatment of this type, an increase in the germination rate and, in particular, in the energy of germination was observed. The improvement was especially marked in the properties of seeds located on the negative electrode during treatment. In this case, an increase in yield of 2-6 centners/hectare was obtained with nearly all the conditions of treatment used. The increase in yield was smaller for plants whose seeds were treated on the positive electrode. Corn seeds, treated in a constant electric field, gave good yields which developed rapidly. The yield of green mass was 30 above the control level. It was shown that green tomatoes ripen faster if they are placed in an electric field close to the positive electrode or between the poles of a magnet, especially close to the south pole.

"The viability and the fertilising power of the pollen at first increased and then decreased as the duration of its treatment in a constant electric field was lengthened. In optimal conditions this fertilising power was increased from twice to four times. The use of high voltage electric fields for the treatment of pollen has led to the modification of its bioelectrical properties and has made it possible to influence the fertilisation process. The setting rate of fruit has been increased during hybridisation of varieties of more distant forms, and the failure to cross distant species of fruiting plants

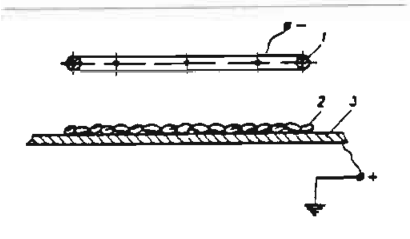
FIGURE 4:

CORONA DISCHARGE SYSTEMS

Fig. 1. Scheme of the first and second series of experiments: 1) corona electrode; 2) seed; 3) earthed electrode.

Fig. 2. Scheme of the experiment to study the effect of electromagnetic radiations on seed; 1) earthed electrode; 2) corona electrode; 3) seed; 4) sheet of dielectric.

Fig. 3. Scheme of the third series of experiments: 1) corona electrode; 2) seed; 3) layer of insulation; 4) earthed electrode.



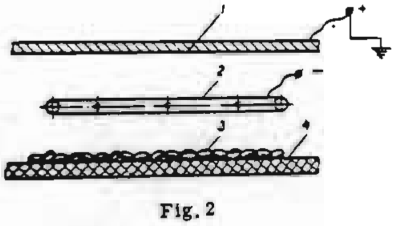


Fig. 2

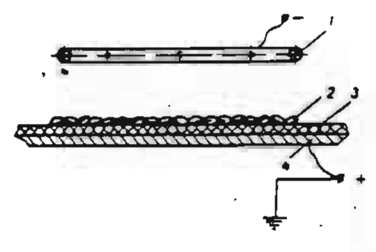


Fig. 3

has been overcome." (Ref.: B. R. Lazarenko and J. B. Gorbatovskaya, *Applied Electrical Phenomena*, no. 6, November-December 1966.) (Figure 4)

Seed-borne bacteria, fungi and insects can be destroyed without injuring the seeds, by application of high-frequency electrostatic fields between capacitor plates. Pests are destroyed when a lethal degree of heat is developed within a few seconds. A longer exposure is required to cause decreased germination of seeds than is necessary to kill pests. (Refs.: T. Headlee, *Journal of NY Entomol. Soc.*, vol 37, no. 1, pp. 59-64, 1929; and *NJ Exper. Station Bulletin*, no. 568, April 1929.)

By this same method, it is possible to increase the power of germination of old seeds which are naturally difficult to germinate. A greater percentage of treated seeds sprout sooner than untreated seeds. High frequency electrostatic fields also may be used to inactivate or enhance enzymatic metabolism of fruits and vegetables, thus prolonging their storability or hastening their ripening. Some chemical changes occur in seeds during such treatment: decreased starch, increased invert sugar, and changes in albumin.

Many theories have been proposed in explanation of the phenomena induced by high frequency currents. Perhaps the most feasible reasons are heating by conduction currents, or dipole antenna resonance.

The lethal effect begins at about 10.4 metres wavelength (29 MHz) when the condenser plates are 2 to 3 cm apart. Other researchers have reported similar effects with the following parameters: plates, 12 cm diameter; current, 5.5 amps; wavelength, 5.6 metres (60 MHz); temperature, 30°-40°C. (Figure 5)

The lethal parameters depend on the wavelength and the voltage gradient of the field strength (the distance between the condenser plates). Increasing either the frequency or the field strength while other factors remain constant, increases the speed of the effect on pests. An increase of either factor requires more current, yet at certain frequencies (around 3 MHz or 100 metres), much less current is required for effective results: about 4,000 volts per linear inch. The shorter the wavelength, the shorter the lethal time. The thickness of the seeds and their moisture content also changes a lethal dose. The temperature of the seeds and pests may rise up to 60°C. ∞

Continued in the next issue of NEXUS...

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